SDCE

DIE CASTING ENGINEER

March, 1959

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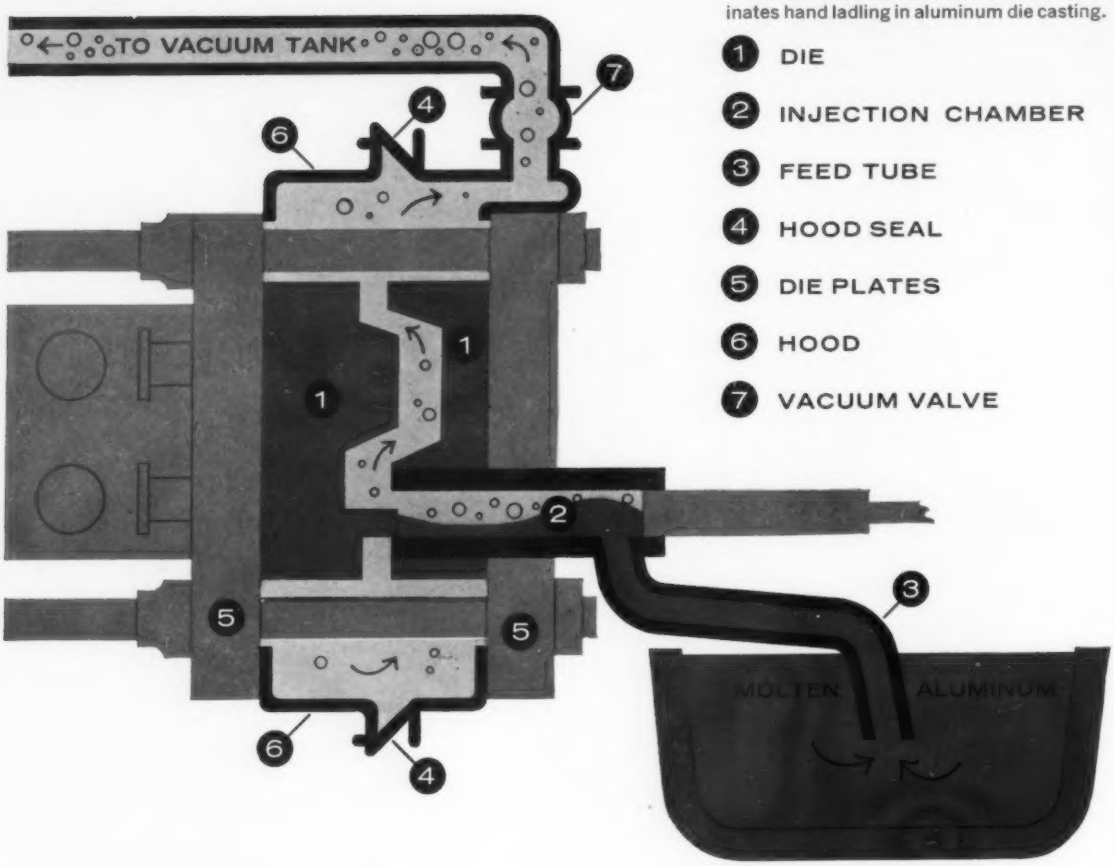

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* * *

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COVER

Indiana's fifty-one mile Lake Michigan waterfront makes this state one of the great industrial centers of the world. Indiana's cities have some of the world's largest industrial plants turning out an endless list of products—iron, steel, oil products, automobiles, farm implements, aviation and railroad equipment, sewing machines, etc. Kokomo, Indiana is the home of SDCE Chapter 25.

UPPER PHOTO—Casting Plant, Delco-Remy Division, General Motors Corp., Kokomo, Ind.

LOWER PHOTO—Chrysler Casting Plant, Chrysler Corp., Kokomo, Indiana.

The DIE CASTING ENGINEER is published quarterly by The Society of Die Casting Engineers, Inc.—a society for the improvement and dissemination of the knowledge of the arts and sciences of die casting, the finishing of metals, and the allied arts. The DIE CASTING ENGINEER offers a concentrated coverage of management and engineering in the die casting and directly related industries.

Only advertising pertaining to die casting and finishing of metals and the allied arts is acceptable. The Society reserves the right to reject any advertising deemed objectionable for any reason what-so-ever.

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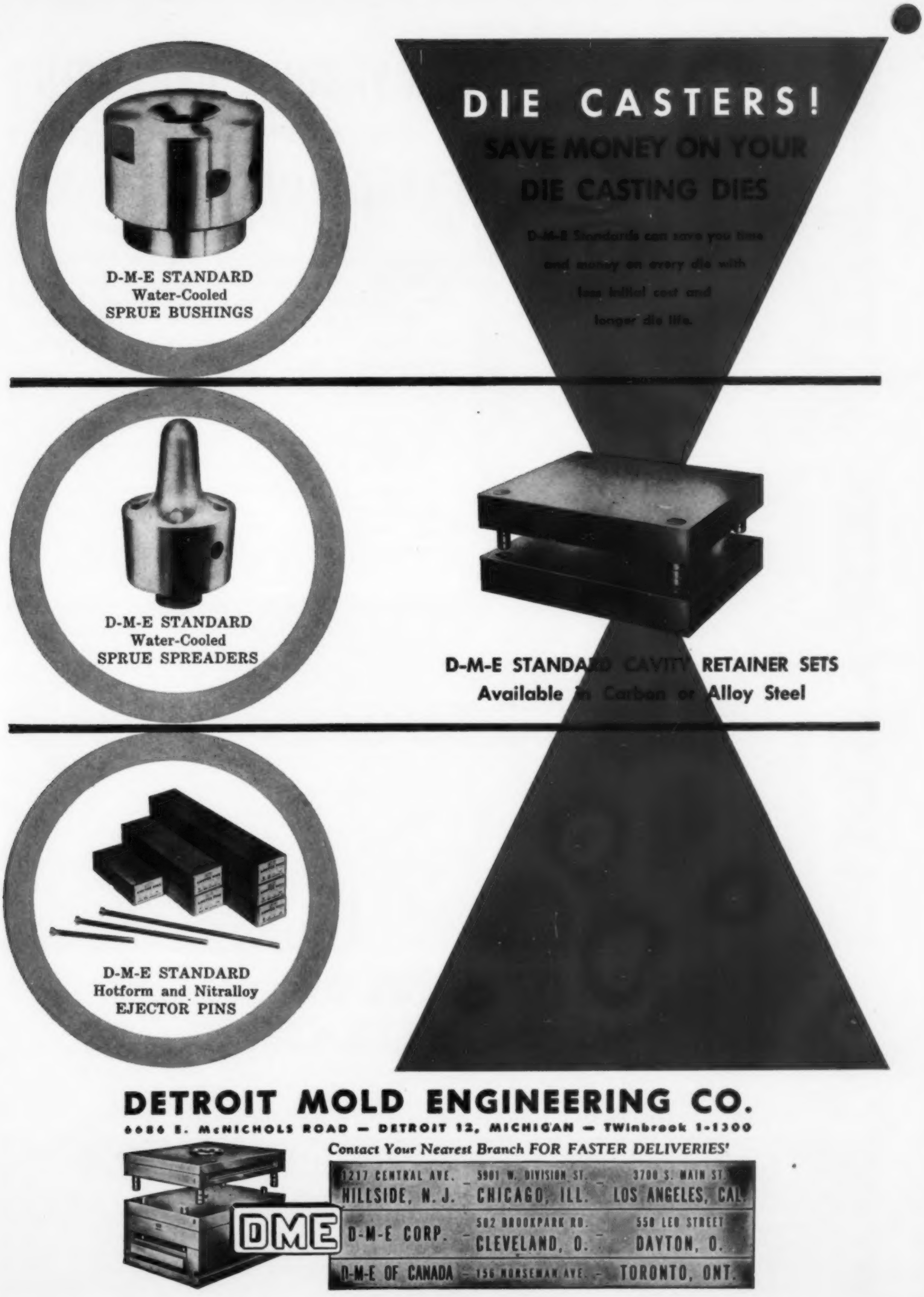

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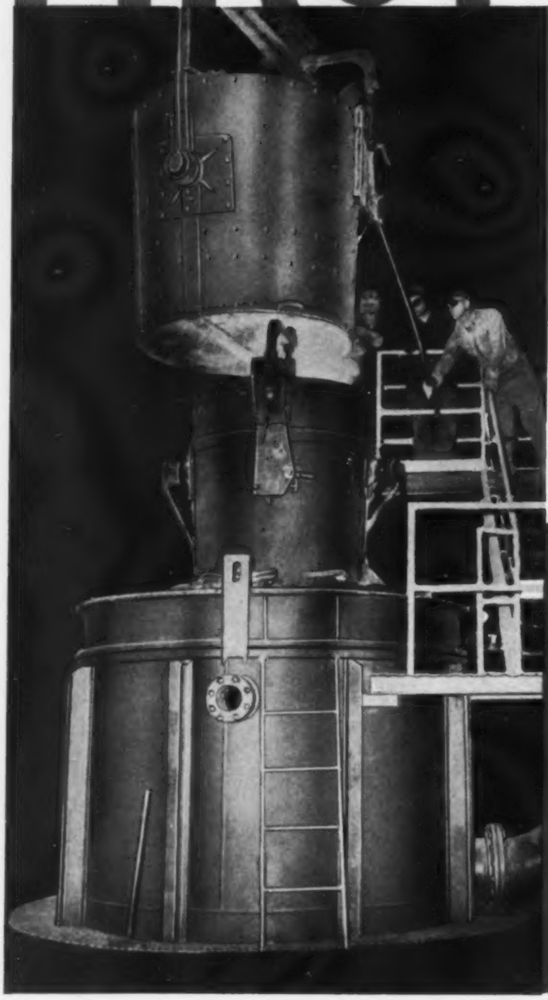

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Combine Six Factors . . .

GET SOUND ZINC CASTINGS WITH GOOD FINISH

SURFACE conditions of a zinc die casting just as they appear to a machine operator or an inspector form the general basis of the casting's acceptability. Of the factors that combine to produce a sound casting of good surface finish, keeping the die at the proper temperature rates with most experienced die casters as a factor of the first order of importance in any hierarchy of factors, since it is the die temperature, neither too hot or too cold, that is regularly credited with preventing such undesirable effects as pits, blisters, and chill and run marks. It is the right die temperature that gives the best finish to the casting when other relevant factors as the temperature of the alloy, the alloy's composition, the injection pressure, the surface finish of the die, and the die's gating and venting have all been effectively combined. The right die temperature that imparts the best finish is always the lowest possible die temperature at which all chills and run marks are eliminated.

Die temperature factor

The size of die casting dies influences the right die temperature. Areas of dies commonly vary from less than a square foot to 20 square feet, and, now and then, some dies are seen with an area of 30 square feet. With size influencing temperature, the right die temperature is not a single value but an average value with a temperature difference of as much as 250 degrees between the hottest and coolest portions of the die.

Experience and observation in the industry agree that zinc die castings of good finish are producible with die temperatures in the range of 300 to 400 degrees Fahrenheit. If a die must be kept at a temperature in excess of this normal range to obtain good finish, some aspect of the die design becomes suspect—the placement of the gate, thickness of the gate, gate runner design, use of overflow wells—and corrective measures should be taken.

Reasons for keeping the dies at the lowest possible temperature consistent with the production of castings of good surface finish are four-fold: first, right die temperature makes possible the production of a casting by rapid chilling which is critical to and distinguishes the die casting process; second, it tends to prevent blistering of thin walled castings containing entrapped air; third, it tends to prevent the soldering, burning, pitting and heat checking of dies; fourth, it improves general die maintenance by permitting core and ejector pin lubricants to hold their lubricating qualities and reduces their tendency to carbonize.

Die temperatures are influenced by the amount of cooling provided, the rate of operation or number of "shots" made per hour and the temperature of the alloy injected into the die. Consider the operation of a machine with a die producing a one pound casting. Each time this amount of alloy together with the excess that accounts for the sprue, gate, gate runners and overflow wells are injected into the die at a given temperature, a certain amount of heat is withdrawn from the mass of hot alloy by the die to chill and freeze the alloy into a solid casting. Were no cooling provided on the die, it would soon attain a temperature approaching that of the alloy and the die's chilling effect on the alloy would be correspondingly diminished. A considerable time would be required for the casting to become solid enough to eject from the die. To prevent this, all die casting dies are provided with drilled channels through which water, steam, air or other coolant is circulated as a cooling medium. Cooling channels are usually provided in both halves of a die at positions requiring greatest cooling such as sprue cover, sprue pin, gate and gate runners and, in some instances, at certain specific locations at some distance from the gate to cool an area over a heavy boss or lug to prevent sink spots or shrunken areas.

In general it is wiser to provide more cooling channels than may be needed than to lack sufficient means for controlling die temperature. In many cases it is necessary to provide cooling on cores around which thick sections are to be cast if high production rates are desired. Such cores are usually cooled by an externally mounted air blast.

The more rapid the rate of operation or the greater the number of shots made per hour on the machine, the more cooling must be provided for the die. If the rate of operation is reduced, the amount of cooling should be correspondingly reduced. During a periodic shutdown, as during a lunch period, the cooling of the die should be stopped entirely to avoid excessive chilling and subsequent loss of valuable time to bring it up to the right operating temperature.

Alloy temperature affects die temperature, but not so much as is commonly supposed. For example, to keep a die at a temperature of about 400°F. when operating at a rate of 200 hundred shots per hour, only a slightly greater amount of cooling is required with an alloy temperature of 800°F. than is required with an alloy temperature of 760°F., and the cooling on the die can be adjusted easily to the operating conditions prevailing. To avoid frequent die cooling adjustment, the alloy temperature should be kept within a fairly narrow range.

Cooling or heat withdrawal from the die should be at a rate equal to the rate of heat input generated by a combination of the alloy temperature and the rate of operation. To achieve this heat balance, the die caster must know where the cooling channels are in the die and how best to use them.

Alloy temperature factor

An alloy temperature range from 740 to 850 degrees Fahrenheit produces castings with acceptable surface finish so long as the proper die temperature is maintained. The quantity of die coolant running through the die should be increased or decreased to suit the temperature of the alloy injected into the die. With a high alloy temperature and a given rate of operation of the casting machine, more die coolant is required than is needed with a low alloy temperature at the same rate of production.

Uniform die temperature during a casting cycle prevails only when the temperature of the alloy is constant, the rate of operation is steady and a consistent volume of coolant is circulated through the die.

Most die casters prefer to operate at the lowest practicable alloy temperature. By doing so they avoid the penalties of long cooling periods for the casting and reduced rates of production. Comparative tests have shown that there are further good reasons for operating in the lower end of the alloy temperature range. Castings produced from alloys held at 825°F. and higher have exhibited inferior physical properties, and the hot alloy rapidly attacks iron pots, goosenecks, plungers and spacers making frequent replacement of machine parts necessary and causing loss of valuable production time.

There is reasonable warrant for high alloy temperature in one instance only and that is at the start of a shift when a high alloy temperature can help bring the die up to operating temperatures. This can often be done more quickly by simply heating the die with torches.

Practical experience dictates the lowest practicable alloy temperature should be used, and the greatest safety is secured between 760 and 780 degrees Fahrenheit.

Composition of the alloy

The composition of the die casting alloy is often a scapegoat given the blame too readily for the production of poor castings. "The metal is not good" is a charge heard when an old or new die is failing to produce satisfactory castings and when difficulty is experienced in machining or trimming castings. The alloy is rarely guilty as charged, although off-grade alloys can be held responsible in some cases. Percentages of alloying elements and their effects are listed in Table 1.

Alloy composition must be within a specified range to guarantee satisfactory physical and mechanical properties of die castings, but excellent appearance alone can be achieved with an off-grade alloy providing it is not so far beyond specification as to produce hot shortness or cracking in the die. The only positive check on composition is chemical or spectrographic analysis.

There are three common zinc base die casting alloys in commercial use. These are known as Number 2, 3 and 5 Alloys. The American Society of Testing Materials designates them in B86 as AC43A, AG40A and AC41A. The Society of Automotive Engineers designates them SAE 921, 903 and 825. The composition of each alloy is given in Table 2.

The alloying elements are copper, aluminum and magnesium. Other elements are impurities which must be kept below specified maximum quantities to obtain optimum physical and mechanical properties in the as-cast condition and the aged condition. Most die casters have standardized on and exclusively use the low copper No. 3 Alloy because of its excellent castability, dimensional stability and physical and mechanical properties.

Metal injection pressure factor

Studies of the effect of injection pressure upon the physical properties and soundness of zinc alloy die castings show there is little advantage gained from the use of pressures in excess of 1600 pounds per square inch. However, there is a tendency to use higher pressures up to 3000 psi for castings of peculiar shape and size where the greater pressures are helpful in filling the die cavity and producing better surface finish.

There appears to be little difference whether the pressure is obtained through a plunger actuated pneumatically or hydraulically. Both compressed air actuation and hydraulic actuation have their champions among die casting machine operators, each side declaiming well for the superiority of the type of shot or plunger action obtained by its favored method.

Correct injection pressure, in any case, assumes proper plunger fit to obtain the pressure theoretically expected from a certain size plunger and plunger actuating force. A loosely fitted plunger is often the cause of failure to produce good die castings, since a loose plunger provides insufficient pressure to pack the alloy solidly in the cavity and hold the alloy firmly against the die surface. Plunger clearance should be checked frequently and, when found excessive, it should be corrected immediately.

Formerly plunger looseness was corrected by reboring and rebushing the gooseneck cylinder and installing a new plunger. Today, most progressive die casters use undersized plungers incorporating one or two cast iron piston rings near the end of the plunger as a means of maintaining proper fit or clearance. New rings are installed when required, and boring and bushing are eliminated.

Equal in importance with the correct injection pressure is the proper combination of plunger and gooseneck cylinder size to obtain a sufficient volume of alloy to fill the casting cavity, gate runners, overflow wells, sprue and nozzle and still have effective plunger travel. Gooseneck cylinder size should be selected so as to have maximum packing pressure conditions with a plunger travel of half the stroke at the very least.

Surface finish of the die

The surface finish of the die cavity is critical to the surface finish of the die casting. A highly polished die cavity invariably produces a die casting with a smoothness of surface greater than that of a casting produced by a poorly polished die cavity. To avoid causing unnecessary turbulence in the alloy prior to its injection into the die cavity, the surface of the gate runner cavities should also be smooth though not necessarily as smooth as the die cavity surfaces.

The surface of the die should be kept in a highly polished condition and blemishes should be buffed or stoned out rather than masked temporarily by die coatings such as potassium bromide or lubricants such as oils, greases and waxes. These expedients should be particularly avoided on the cover half of the die. They usually leave an insulating layer on the die surface inhibiting chill or heat withdrawal by the die. That some lubricants spoil the finish of castings can be seen by comparing the castings that come off immediately after lubricating the die with those that follow after the lubricant is removed by subsequent shots. Continued use of lubricants leaves a carbonized or burnt deposit on the die that must be removed by stoning.

If a die coating or lubricant is used to avoid stoppage for die correction, such as when a drag or slight undercut develops on a die during production, then the application should be restricted, if possible, to the back or ejector portion of the die. If a drag or undercut must be treated on the front or cover portion of the die, it is better to use a lubricant than a coating material. The lubricant used should be one with good heat resisting qualities that leaves little or no carbon residue. In no case are these expedients effective substitutes for a highly polished die surface.

Gating and venting the die

It is impossible to treat all phases of gating and venting the die in so compressed a review of important die cast-

ing factors as this, but mention of the most salient aspects of gating and venting is certainly in order; for example, the thickness of the gate opening, the venting and use of overflow wells and gate runner design.

In any design the thickness of the gate opening is dictated by past experience, size of the casting, shape of the casting and the type of finish required. If good finish can be obtained only by keeping the die so very hot that pits and blisters occasionally appear, then the thickness of the gate can be deemed inadequate, for these faults are usually associated with a thin gate. A thin gated die is likely to solder near the gate or hot portion of the die, producing a build up of metal on the die surface. This build up is actually an alloying or combining of the metal with the die steel. It leaves a depression on the casting, rendering its surface particularly unsuitable for plating. Polishing or oiling is unable to remove soldering from the die. Stoning, rubbing with a very fine emery cloth, application of various caustics or weak acids are only temporary expedients for this condition. However, soldering can be avoided by increasing the gate opening.

A heavy gate opening permits the alloy to flow rather than spray into the die. Flow makes for sounder castings and permits good finish to be obtained at a lower die temperature. The disadvantage of a heavy gate opening is the difficulty it offers to hand trimming and breaking-off which, in some cases, may leave holes or breakouts.

Gate openings of 0.025 to 0.030 inch are thin; those of 0.040 inch or better are considered heavy, depending upon the section thickness of the casting. Certain large grille castings have gate openings from 0.080 to 0.090 inch. General practice suggests gate openings of 0.040 to 0.060 inch whenever possible.

Placement of gate openings is usually decided so that the alloy flow is in one direction with minimum interference from the cores. If a bad surface condition is occuring regularly at a particular area of a casting, such as blisters, swirls or chills, slight alteration of the gate placement may eliminate the grievance. In some cases the bad condition can be eliminated without altering the gate placement by resorting to more venting or overflow wells.

All dies must be properly vented. Adequate means must be provided for the escape of air in the casting cavity prior to filling the cavity with alloy. If easy and adequate escape channels are not provided, then the air will be trapped in the casting and will produce blisters, particularly in thin wall castings, and generally will produce porous and inferior castings.

Venting is usually accomplished by using channels 0.004 to 0.005 inch thick at the parting of the die in positions that are likely to entrap air. In addition to using vents, advanced die design calls for the use of overflow wells or draw pockets placed strategically around the casting cavity, not only to provide an escape for the air from the casting cavity, but also to draw or bleed the alloy around a corner or core and help keep a uniform die temperature necessary to the production of good surface finish.

A revealing hint that more venting or overflow wells are needed is this: blisters developing in a casting when the die is not up to temperature. To temporarily provide more venting run the die with increased flash by shimming. Swirls or porous areas can often be eliminated by more venting or the use of overflow wells, especially if such defects occur at a great distance from the gate or near a core or other obstruction in the die.

Gate runner design is equal in importance to proper placement and thickness of the gate opening. The best gate runner is one that permits a decrease in velocity and allows development of increased pressure at the gate opening.

Combination of these six factors—proper die temperature, proper alloy temperature, suitable alloy composition, suitable injection pressure, good surface finish on the die, appropriate gating and venting—forms the basis for producing sound die castings with a good surface finish. Neglect of any single element is equivalent to neglecting them all.

Abstracted from pamphlet entitled DIE CASTING WITH ZINC ALLOYS, published by Henning Bros. & Smith Inc.

TABLE 1

LOW ALUMINUM (1.5 to 2.0%) adversely affects fluidity or castability. Difficulty will be experienced in satisfactorily filling thin walled castings of complicated shape.

HIGH ALUMINUM (4.6 to 5.5%) adversely affects impact strength. Castings produced from such an alloy are likely to be brittle, tending to crack in any subsequent forming or straightening operation.

HIGH COPPER (greater than 3.75%) makes the alloy sluggish. Difficulty will be experienced in filling thin walled castings of complicated shape.

HIGH MAGNESIUM (greater than 0.06%) promotes hot shortness or weakness when hot. This condition promotes cracking of the casting while in the die prior to ejection. Such cracking is generally confined to castings of complicated shapes that are not free to shrink in the die.

HIGH LEAD, CADMIUM AND TIN each promotes hot shortness or a tendency of the casting to crack in the die prior to ejection much in the same manner as does high magnesium.

TABLE 2

COMPOSITION OF ZINC BASE DIE CASTING ALLOYS

	Alloy AC43A	Alloy AG40A	Alloy AC41A
Aluminum	3.5–4.5%	3.5–4.3%	3.5–4.3%
Copper	2.5–3.5%	0.25% max.	0.75–1.25%
Magnesium	0.02–0.10%	0.03–0.08%	0.03–0.08%
Iron	0.100% max.	0.100% max.	0.100% max.
Lead	0.007% max.	0.007% max.	0.007% max.
Cadmium	0.005% max.	0.005% max.	0.005% max.
Tin	0.005% max.	0.005% max.	0.005% max.
Zinc	remainder	remainder	remainder

NOTE: These specifications refer to die castings, not ingot. Alloys in ingot form carry lower impurity limits (ASTM B240).

THE SDCE NATIONAL STANDARDS COMMITTEE *working with the manufacturers of die casting machines has finalized a group of Platen Plan Standards. Additional standards are being completed now. It is hoped these standards will serve industry and government in making the interchangeability of dies on various die casting machines easier.*

The Society of Die Casting Engineers

DIE CASTING MACHINE STANDARDS

SDCE CLAMPING CAPACITY STANDARD

F. CLAMPING CAPACITY

1. SCOPE

This method of test covers the procedure for determining the maximum clamping load developed by die casting machines up to 2000 tons.

2. APPARATUS

The apparatus for testing a given machine shall consist of the following:

a. One Type N portable strain indicator, or approved equal.

b. 24 Type AB-3 or 24 Type AB-5 Sr-4 strain gages of 120 ohms nominal resistance or approved equal.

c. Armstrong Epoxy cement, Bakelite cement or approved equal.

All of the above apparatus may be ordered from Baldwin-Lima-Hamilton Corp., Testing Equipment Dept., Phil. 42, Pa., or an approved equal source except the Armstrong Epoxy cement which can be ordered from Armstrong Products Co., Argonne Road, Warsaw, Indiana or an approved equal source.

d. 75 feet of number 20 plastic insulated copper wire.

e. One type 430 Helicoid test gage, or approved equal. Range 0–3000 p.s.i. or 0–6000 p.s.i. 8½″ white dial; one-fourth of one per cent accuracy; flangeless type, bottom connected, stem mounted, ¼″ pipe thread, metal case.

f. One cylindrical hollow steel test ring, with parallel end surfaces and with dimensions as indicated hereinafter:

Ring "A" for machines with ratings from 35 to 150 tons, 8″ O.D. x 5″ I.D. x any length convenient for the machine between 8″ and 10″.

Ring "B" for machines with ratings from 75 to 350 tons, 13″ O.D. x 10″ I.D. x any length convenient for the machine between 8″ and 12″.

Ring "C" for machines with ratings from 200 to 500 tons, 18″ O.D. x 14½″ I.D. x any length convenient for the machine between 12″ and 18″.

Ring "D" for machines with ratings from 350 to 1000 tons, 28″ O.D. x 24″ I.D. x any length convenient for the machine between 20″ and 30″.

Ring "E" for machines with ratings from 750 to 2000 tons, 39½″ O.D. x 34″ I.D. x any length convenient for the machine between 34″ and 50″.

For lifting, locate a threaded eyebolt hole in the approximate center of the ring, lengthwise: a ½″ eyebolt hole for ring sizes A, B and C; a ¾″ eyebolt hole for ring size D; or a 1¼″ eyebolt hole for ring size E. On rings C, D and E two threaded eyebolt holes are permissible. Near one end of the ring a ½″ clearance hole for bringing out the lead wires from the strain gages is permissible.

3. PREPARATION

The SR-4 strain gages, 24 in number, are cemented in pairs on the inside surface of the ring at intervals of 30° around the circumference at the approximate center of the ring lengthwise. In each of the twelve pairs of gages, one gage is mounted so as to measure strain along the axial direction; the other gages mounted at right angles to the first so as to measure circumferential strain. Each pair of gages thus forms a T-shaped configuration. The gages are wired so as to form a 4-leg full Wheatstone bridge circuit; two legs containing six axial gages each, the other two legs containing six circumferential gages each. The complete circuit is wired by alternating axial and circumferential legs.

4. CALIBRATION

a. With the gages securely mounted and checked for short circuits, the test ring is calibrated on a Universal Testing Machine of the type generally available at any engineering college and periodically checked for accuracy in accordance with ASTM Standard E4-50T. With the ring in place, the testing machine slowly loads and unloads the ring several times to insure proper seating and loading with the readings of the strain gages noted on the strain indicator. When the unloaded ring consistently returns to a zero reading, the test loading begins with strain being recorded on the indicator. The ring is calibrated through the entire die casting machine range or testing machine range, whichever is lower.

b. Where the die casting machine to be checked has a greater clamping tonnage than the testing machine available, the partial calibration from the testing machine will be acceptable as if the entire range had been calibrated; if the response of the ring is linear throughout the calibrated range, and provided the calibrated range is not less than 40% of the total range over which the ring will be used.

c. This calibration will determine the calibration constant, K, of the ring, which is defined by the equation: Load in tons = K × strain indicator reading in micro-inches/inch. The calibration constant is to be determined with the gage factor setting of the strain indicator at 2.00. All subsequent tests shall be run with the same gage factor setting. The calibration constant, K, as determined by test shall be checked against the following formula and shall conform within 5%:

$$K = \frac{(0.0115 \times A)}{G.F. \times M}$$ (See derivation of equation below)

A = Cross-sectional area of ring in square inches.
G.F.=Gage factor AB-3 or AB-5, SR-4 gages used.

d. The date of this calibration shall be stamped on the ring and a written report from the testing agency shall be secured.

e. The test oil gage shall be calibrated against the master gage, or a dead weight tester, for accuracy. The date of calibration shall be marked on the gage and a written report from the testing agency shall be secured.

5. PROCEDURE

a. The test ring, thus calibrated and marked with the date of calibration, should be mounted in the centerline of the machine to be tested and, if necessary, supported in this position with wooden boards and blocks. During the test the calibrated oil pressure gage should read the maximum setting recommended by the machine manufacturer for the machine in question. The clamping tonnage of the machine should be tested at this pressure setting. The machine is locked up against the test ring. The parallel ends of the test ring should be in full engagement with the surfaces of the two platens. The maximum clamping tonnage is recorded at the point of toggle adjustment just before the machine clamp will stall. At this setting of clamp the deflection of the strain gages in the test ring is recorded on the Baldwin-Southwark Model N strain indicator. This strain reading multiplied by the calibration factor for test ring gives the maximum clamping tonnage of the machine being tested.

b. Three machines of given model shall be tested by the above procedure to establish rated clamping capacity. The rated clamping capacity shall be considered established, provided none of the three test readings shall fall below the assigned capacity by more than 2½%.

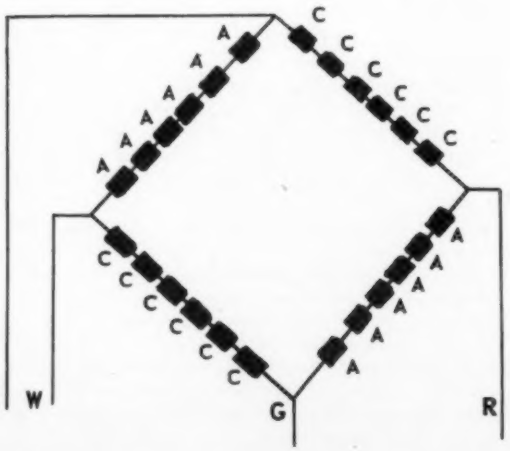
6. CERTIFICATION

The calibration of the test ring, the calibration of the oil pressure gage and the clamping pressure tests should be carried out by each manufacturer. A report should be maintained including the date of calibration of the test ring, as well as the date of calibration of the calibrated oil pressure gage.

7. PUBLICATION

When a manufacturer shall represent that he has carried out his locking tonnage test in accordance with the test method herein described, he may be authorized to enter on any specification sheets the notation "Determined by SDCE Clamping Capacity Test Method."

Example: Clamping Capacity (Determined by SDCE Clamping Capacity Test Method)______tons.



DERIVATION OF EQUATION FOR CALIBRATION CONSTANT OF TEST RING

Calibration constant, K, is defined by:

Load in tons = K × strain indicator reading in micro inches per inch. If e is longitudinal strain in ring due to load-inches/inch.

$$e = \frac{\text{Stress}}{E} = \frac{F}{AE}$$

F = Force in lb.
A = Cross-sectional area—sq. in.
E = Modulus of elasticity of ring material.

Since transverse gages are used for temperature compensation and since they are subjected to a strain of — .3 times because of Poisson's effect, the output of any pair of gages will be 1.3 times the output of the longitudinal gage. If the gage factor adjustment on the indicator is set at 2.00 and the actual gage factor of the gages used is G.F. and if a four-legged bridge is used, the strain indicator reading

$$\times 10^{-6} = 2 \times e \times 1.3 \times \frac{G.F.}{2.00}$$

Since the resistance of each leg of the bridge is different from 120 ohms, the gage factor of the gages used (G.F.) must be multiplied by a factor "M" which accounts for changes in circuit sensitivity. For a resistance of approximately 500 ohms or less in each leg, the factor "M" may be taken as equal to about 1.0; for a resistance of approximately 720 ohms in each leg, the factor "M" may be taken as equal to about 0.965.

Strain indicator reading

$$= \frac{F}{AE} \times 1.3 \times \frac{G.F.}{2.00} \times 2 \times M \times 10^6 \quad F \text{ is in lb.}$$

$$\text{or } F = \frac{AE}{1.3} \times \frac{2.00}{G.F.} \times \frac{1}{2 \times M} \times \text{Reading} \times 10^{-6}$$

Reading is in micro inches/inch.

or Tons load =

$$\frac{F}{2000} = \frac{AE \times 2.00}{2000 \times 1.3 \times G.F.} \times \frac{1}{2 \times M} \times \frac{\text{Reading} \times 10^{-6}}{1}$$

if ring is made of steel for which $E = 30 \times 10^6$

Tons load =

$$\frac{A \times 30 \times 10^6 \times 2.00}{2000 \times 1.3 \times G.F.} \times \frac{1}{2 \times M} \times \frac{\text{Reading} \times 10^{-6}}{1}$$

$$= \frac{30\ A}{2600\ G.F. \times M} \times \text{Reading}$$

$$= \frac{(0.0115\ A)}{G.F. \times M} \times \text{Reading}$$

By comparison with the first equation $K = \frac{0.0115\ A}{G.F. \times M}$

Left—Wiring diagram of strain gage circuit. The gages are wired in series so as to form a 4-leg full Wheatstone bridge circuit; two legs containing six axial (A) gages each, the other two legs containing six circumferential (C) gages each. The complete circuit is wired by alternating axial and circumferential legs.

CORRECTION

DIE CASTING MACHINE STANDARDS, Platen Plan Standards, DCE, December 1958, pages 16-7. Drawing No. 3—SDCE Die Casting Machine Bolting or T-Slot Pattern; the T-slots shown 3" above and below centerline should be located 6" above and below centerline.

Chapter News

NATIONAL

The National Office of the SDCE and the office of the DIE CASTING ENGINEER have been moved to a more spacious location at 19382 James Couzens Highway, Detroit 35, Michigan. This move was made in line with the National Office's policy of providing better coordination with the local chapters of our rapidly growing Society.

The new offices gleam with a new conference table and chairs and an office valet graciously presented to the national organization by joint Chapters 1 & 2, Detroit and Saginaw Valley.

1 DETROIT and
2 SAGINAW VALLEY

Although no fisticuffs were involved, those attending the March dinner meeting of Chapters 1 & 2 witnessed "Sparring Partners in Aluminum—Permanent Mold Versus Die Castings," a debate on the relative merits of the two processes where they compete in aluminum casting. The hero of the battle was Norman W. Bestor, Automotive Engineer, Alcoa Development Division, upholding the role of aluminum die castings. The villain, Wayne C. Keith, Manager Central Engineering Section, Alcoa Development Division, who extolled the virtues of permanent mold castings. Refereeing the bout was Richard P. Baribault, Sales Engineer, Aluminum Company of America. The audience was treated to a no-punches-pulled discussion which stripped the mystery from the competitive advantages gained in the use of aluminum die castings versus aluminum permanent mold castings, or vice versa, in various applications.

3 WESTERN MICHIGAN

Chairman: C. M. Stewart, Holland Die Casting Co.
Vice-Chairman: M. J. Nelson, Grand Rapids Plating Co.
Secretary-Treasurer: Russell Uplinger,
Grand Rapids Die Casting Co.

Chapter 3 was host to J. C. Petter, Vice President and Chief Engineer, B & T Engineering Co., at their February meeting at the Schnitzelbank Restaurant, Grand Rapids, Michigan. Mr. Petter presented a highly interesting and controversial talk on "Vacuum Die Casting of Zinc and Aluminum."

4 TOLEDO

Dean L. Rockwell, President, THE SOCIETY OF DIE CASTING ENGINEERS, INC., was the guest of honor of Chapter 4 at their March dinner meeting at Angelo's Spaghetti House, Toledo, Ohio. Mr. Rockwell's appearance was part of his program as President to visit all the Chapters possible thus providing better communication between the Chapters and the National Office. He outlined plans for national growth of the society and closer cooperation with the Chapters, and he noted projects now sponsored by the SDCE.

Some of the projects cited by Mr. Rockwell were translations of Russian papers on die casting, work by members on the new crack-free chromium process and work on the new European sulphurizing process for die cast dies which gives better castings and longer die life.

A short series of talks on the topic of "Finishing of Zinc Die Castings" made up the rest of the program.

As a fine gesture of common interest, the Toledo branch of the American Electroplaters Society were the guests of Chapter 4 at this meeting.

Chapter News

5 CHICAGO

Chairman: John H. Koller, Sunbeam Corp.
Vice-Chairman: Clarence Fostle, E. Toman & Co.
Secretary-Treasurer: Dave Edgerton,
Lindberg Steel Treating Co.
Historian-Librarian: Edward Bares, Dormeyer Corp.
Chairman of Trustees: Ray Dunn, Lindberg Engineering Co.
Two Year Trustee: Al Hesse, R. Lavin & Sons
Three Year Trustee: Walter Kosmala,
Acme Die Casting Corp.

"Proper Melting and Handling of Aluminum Can Save You Money" was the title of the talk presented by Ray Dunn, Lindberg Engineering Company, at the March meeting of Chapter 5. Mr. Dunn introduced many useful ideas for economies in the handling of aluminum casting alloys.

6 CLEVELAND

J. C. Petter, Vice President, B & T Machinery Company, spoke on "Vacuum Zinc and Aluminum Die Casting" at the February dinner meeting of Chapter 6. Mr. Petter described research done in vacuum die casting at the B & T laboratory.

The March meeting of Chapter 6 featured a panel discussion on "Fire Resistant Hydraulic Fluids." The panel was composed of five suppliers of hydraulic fluid.

7 NEW YORK

"Vacuum Zinc and Aluminum Die Casting in the B & T Research Lab" was the title of the talk presented by J. C. Petter to the January meeting of Chapter 7 at the Hotel Governor Clinton. Mr. Petter is a graduate engineer and Vice President of B & T Machinery Company. The talk described work done in the lab on vacuum zinc and aluminum die casting, automatic machines, and how these processes work mechanically. Films and slides were shown to illustrate the talk.

18 NEW ENGLAND

Chairman: Patrick J. Hughes II, General Electric Co.
Vice-Chairman: Milton Harmon, Cast-Master, Inc.
Secretary-Treasurer: Ernest W. Brix,
Hampden Brass & Aluminum Co.
Historian: John Weber
One Year Trustee: Alvin J. Moore, R. E. Phelon, Inc.
Two Year Trustee: William Bosyk,
Westinghouse Electric Corp.
Three Year Trustee: Frank Formalarie,
Form-A-Die Casting Corp.

John Rolland, Applications Engineer, Vickers Inc., was the guest speaker at the February meeting of Chapter 18. "Hydraulic Progress in the Die Casting Industry—Its Applications and Maintenance" was the title of Mr. Rolland's talk.

25 INDIANA

Casa Grande Restaurant, Kokomo, Indiana, was the scene of the January meeting of Chapter 25. "Vacuum Die Casting of Zinc and Aluminum in the B & T Research Laboratory" was the subject of a talk presented by Jay C. Petter, Vice President, B & T Machinery Company. Mr. Petter is considered an expert in this field having been associated with machinery in the wood, rubber, plastics and metal working fields for over 15 years.

SDCE SUPPORTING COMPANY MEMBERS

SUSTAINING MEMBERS

American Mold Engineering Co.
Braeburn Alloy Steel Corp.
Cast-Master, Incorporated
Chrysler Casting Plant, Chrysler Corporation
Congress Die Casting Division, The Tann Corporation
Cuyahoga Industries
Dodge Steel Company
Double A Products Company
J. R. Elkins, Inc.
Process Development Section, General Motors Corporation
Latrobe Steel Company
Lester Engineering Co.
Permanent Mold Die Co., Inc.
Reed-Prentice Division, Package Machinery Company
Universal Die Casting Division, Hoover Ball & Bearing Co.

COMPANY MEMBERS

All State Industries, Inc.
Aluminum Die Cast Foundries, Inc.
Atlantic Chemicals & Metals Co.
B & T Machinery Company
Briggs & Stratton Corp.
Central Die Casting & Mfg. Co., Inc.
H. Cohn & Sons
Damen Tool and Engineering Co.
Detroit Mold Engineering Co.
Disdie Steel, Incorporated
Dominion Die Casting Ltd.
Johnson Motors, Outboard Marine Div.
Girard Mfg. Company
Grand Rapids Die Casting Co.
Guild Platers Co., Inc.
Henning Bros. & Smith, Inc.
Holland Die Casting Co., Inc.
E. F. Houghton & Co.
R. Lavin & Sons, Inc.
Lindberg Engineering Co.
Lindberg Steel Treating Co.
Martin Grinding & Machine Works, Inc.
Ostrom Tool Company
Prospect Die and Mold, Inc.
Roth Smelting Company
Universal Cyclops Steel Corp.
Hawthorne Works, Western Electric Co.
Wabash Smelting Inc.
Charles Zapf & Co.

NEW BOOKS

A Handbook of Lattice Spacings and Structures of Metals and Alloys. W. B. PEARSON. 1044 pages. Pergamon Press, Inc., 122 East 55th Street, New York 22, New York. 1958. $38.00.

One thousand and forty-four pages of desk-side reference data respecting the structures and lattice spacings of all binary and ternary alloys examined to date, makes W. B. Pearson's book king sized; its price is a regal one, too, but it's not inflated, not one bit, when one considers the aid it renders the physicist and metallurgist. It does not pretend to be a historical catalogue given to ascribing credit for discoveries of phases or determinations of structures; and hence it avoids discussing pioneering efforts, and limits itself to the practical task of giving the latest and most nearly definitive description of each phase or alloy system. It has done this well and in such detail that it is a gratuitous gesture on the part of the researcher to consult the original sources of the descriptions. It does, however, fully list the source papers and does so in the immediate vicinity of the work described. This method of presentation compels the author to contrast his *Handbook of Lattice Spacings and Structures of Metals and Alloys* with the numerously volumed and exhaustive works, *Strukturbericht* and *Structure Reports.* These respectable works tenant a great deal of library space and, of course, cost a great deal more than the *Handbook.* Books of lesser ambition than these, in dealing with alloy structures, have neglected to give space to full references and details of metal treatments and purity or to the variation of lattice parameters of intermetallic phases with composition and temperature. The *Handbook* remedies the bulkiness of the two great and fruitful works mentioned and the leanness of the multifarious shorter reference efforts.

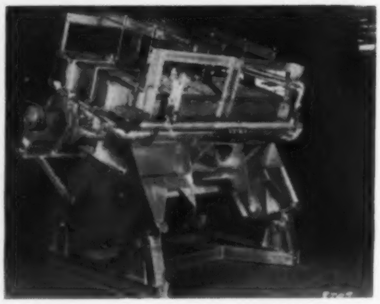
In condensing the extensive literature embracing several thousand binary alloy systems, Dr. Pearson apologizes for an effective compromise he achieved in the work, declaring that while it had been his intention to give details of alloy preparation, heat treatment and metal purity, it was found necessary to reduce slightly the amount of information that might otherwise have been included from the results of x-ray investigations. There is, nevertheless, sufficient information included to plot all but a few of the most complex structures. The atom positions and interatomic distances of all the garden varieties of *Strukturbericht* types are tabulated, as well as such atomic parameters as have been determined for individual structures. The equivalent positions and atomic parameters of less common structures are also given so that by referring to the *International Tables for X-ray Crystallography* the exact atom positions can be plotted. In the treatment of lattice parameter variations with concentrations and temperature, considerable detail is given. Lattice spacings of alloys located in single phase regions are tabulated, but lists of parameters of alloys which have been isothermally annealed and quenched from two-phase regions in binary systems are omitted.

The *Handbook* surveyed thoroughly the literature up to 1955 and pursued the journals through 1956, using as a basis for the survey the abstracts of the Institute of Metals back to 1936. It covered Japanese and Russian literature through the war period and the years following, and also the FIAT Reviews of German Science from 1936 through 1946.

The particular achievement of this compilation is this: it is the first to bring together all of the detailed x-ray work on metals and alloys in a single, readily manipulable volume. There may be more than a few of its users who will wish that some terms were more amply defined, but none of them will regret the book for that.—Ralph Verlaine.

NEWS of the INDUSTRY

KOZMA INTRODUCES A NEW LINE OF ALUMINUM MELTING FURNACES



A new line of radiant-fired, tilting, reverberatory furnaces for aluminum melting has been introduced by the J. A. Kozma Co., Dearborn, Michigan. The furnaces are ideally suited for use as common melting furnaces in die casting, permanent molding and sand casting operations, as well as secondary scrap melting.

A charging well, rather than a door, facilitates the removal of iron or steel inserts in scrap die castings. By inserting a hook or other lifting device in the insert, it may be easily removed when the aluminum casting has melted in the bath.

The entire furnace rides on bearing-mounted rails and tilts through a 20° arc for pouring.

CIRCLE 14 READERS SERVICE CARD

ABRAMS AND WELSH NEW ASSISTANT MANAGERS OF RESEARCH AT E. F. HOUGHTON

Dr. Ellis Abrams and **Paul J. Welsh** have been promoted to Assistant Managers of Research by E. F. Houghton & Co., Philadelphia. Responsibility for supervision of textile, paper and organic research goes to Dr. Abrams. Mr. Welsh will supervise the company's research in metal working, rust preventives and lubrication.

ANNUAL AFS CASTINGS CONGRESS IN CHICAGO APRIL, 13TH

The Die Casting and Permanent Mold Division of the American Foundrymen's Society will hold an interesting and informative program at the coming sixty-third A.F.S. Castings Congress and Engineered Castings Show. The show will be held in Chicago, Illinois on April 13, 1959 through April 16, 1959.

CIRCLE 15 READERS SERVICE CARD

KOEHRING PURCHASES CAST-MASTER FOR $1.5 MILLION

The Koehring Co., Milwaukee, Wisconsin, announces the purchase of Cast-Master, Inc., of Bedford, Ohio, one of the largest manufacturers of die casting equipment in the industry. Julian R. Steelman, president of Koehring, said the purchase involved exchange of stock in excess of $1,500,000.

Cast-Master will operate with the same personnel as a part of Koehring's Hydraulic Press Manufacturing division.

CIRCLE 16 READERS SERVICE CARD

DIS-DIE STEEL APPOINTS SNYDER GENERAL MANAGER

Dis-Die Steel, Inc., announces the appointment of **Robert M. Snyder** as General Manager. Mr. Snyder brings to Dis-Die Steel many years of experience in the steel business.

NEW COLD CHAMBER PLUNGER LUBRICANTS REDUCE SHOT-SLEEVE REPLACEMENT PROBLEMS

Development of a new series of cold chamber die casting plunger lubricants that will reduce shot-sleeve replacement problems by 75% is announced by the American Charcoal Co., Detroit, Michigan.

CIRCLE 17 READERS SERVICE CARD

LATROBE STEEL PROMOTES

Eaton

Hochdanner

Dodge

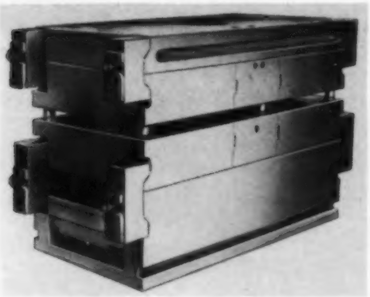
The Latrobe Steel Co., Latrobe, Pa., announced the following advancements:

James C. Eaton has been named Assistant to the Vice President of Operations.

Eugene J. Hochdanner has been appointed Chief Engineer. He will be in charge of engineering design, installation, and maintenance of buildings, equipment and facilities.

James H. Dodge has been named Manager of Specialty Steels. He has been a member of Latrobe's sales staff for 25 years.

DME INTRODUCES STANDARD UNIT DIE ASSEMBLIES FOR ZINC AND ALUMINUM DIE CASTING



Standard unit die assemblies are now available for zinc and aluminum die casting. Manufactured by Detroit Mold Engineering Co., the new unit-die construction enables the diecaster to replace cavities at minimum cost in a matter of minutes.

Three sides of the die are open for easy installation of cores or coolant lines. The twin replacement units are standard 9⅞" x 11⅞" to assure availability of cavity plates from stock. The unit dieholder includes a watercooled sprue bushing, sprue spreader, leader pins and wedge clamps.

CIRCLE 18 READERS SERVICE CARD

ALL THERMOLD AV INGOTS NOW VACUUM DEGASSED

Universal-Cyclops Steel Corp. has installed vacuum degassing equipment in its Bridgeville, Pa., plant. All large size ingots of Thermold AV are now vacuum degassed by Universal-Cyclops as standard production processing. This new processing technique contributes to homogeneity of structure, freedom from gaseous impurities, high polishing quality and increased resistance to thermal and mechanical fatigue.

CIRCLE 19 READERS SERVICE CARD

CIRCLE 20 READERS SERVICE CARD

CIRCLE 21 READERS SERVICE CARD

CIRCLE 22 READERS SERVICE CARD

DIE CASTING SERVICE AND PERSONNEL OPPORTUNITIES

This section is open to everyone associated with the arts and sciences of Die Casting. The editorial staff reserves the right to reject any advertising.

As a service to the Die Casting Industry, we offer space at a minimum of $10.00 for the first column inch and $10.00 for each additional column inch or any part thereof, payable in advance.

To answer box number advertisements, address responses to the box at Die Casting Engineer, 19370 James Couzens Highway, Detroit 35, Mich.

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with full die casting know-how. Top of engineering tree in present job, so ambition says "ON!". U.S.A. or Canada. Write Box 111.

DIE CASTING AND PLATING CO. is seeking sales representation for quality zinc die castings that require beautiful plating in any finish. Write Box 112.

Technical Literature

■ **Allied Research Products, Inc.,** Baltimore, Maryland has announced the issuance of a new technical data file on process chemicals for metal finishing. It includes complete data on the Iridite chromate conversion coatings for all metals, Isobrite plating brighteners and ARP process chemicals and supplies.

CIRCLE 24 READERS SERVICE CARD

■ **E. F. Houghton & Co.** has prepared an illustrated talk on fire resistant hydraulic fluids which its engineers can give to interested engineering and die casting groups. The title is "Unscrambling the Fire Resistant Fluid Puzzle." This talk is illustrated with 35mm slides and takes about 30 minutes.

CIRCLE 25 READERS SERVICE CARD

■ **Latrobe Steel Co.,** Latrobe, Pa., has just published a 12 page brochure on Blast-Mor Shot Blast Liners for shot blast machines. The bulletin, Number 958, features a series of schematic illustrations of standard wheel housings with breakdown drawings of individual parts.

CIRCLE 26 READERS SERVICE CARD

■ A new four-page folder entitled "The Evolution of Modern Cutting Fluid" is available from **E. F. Houghton & Co.,** 303 West Lehigh Ave., Philadelphia 33, Pa. This folder describes the development of coolants from water to fortified petroleum bases, then to heavy-duty water soluble concentrates, and now to chemically conceived coolants containing no petroleum.

CIRCLE 27 READERS SERVICE CARD

■ **The New Jersey Zinc Co.** is offering a completely revised edition of "The End Uses of Zinc Die Castings." This 1958 edition contains 192 new photographs, 2 new sections, 14 additional pages and many new applications of zinc die castings. The earlier booklet, published in 1953, has been used extensively throughout the industry in promoting new uses for ZAMAK alloy die castings.

CIRCLE 28 READERS SERVICE CARD

■ **Magnuson Products Corp.,** Brooklyn, New York, has prepared supplemental sheets for insertion into its book, "Permag Compounds for Barrel Processing," issued last year. The new information covers several new compound-abrasive materials which provide better cutting, deburring and removal of flash. Copies of the sheets or the complete booklet are available.

CIRCLE 29 READERS SERVICE CARD

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Reduce your costs with

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- **Eastern Rep.** Milton Harmon, 223 Pine Tree Drive, Orange, Connecticut
- **Midwest Rep.** C. W. Stone Co., Minneapolis, Minnesota
- **Western Rep.** Sydney J. Wills, 2120 Strand, Hermosa Beach, Calif.
- **Central-West Rep.** Earl L. Johnson, 1696 Webster Lane, Des Plaines, Illinois

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CIRCLE 34 READERS SERVICE CARD

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